Matrix Project

EE-1390

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Geometrical Question

The point diametrically opposite to the point $P(1, 0)$ on the circle $x^2 + y^2 + 2x + 4y - 3 = 0$ is

Matrix Transformation

- Given circle in matrix form:

$$\mathbf{x}\mathbf{x}^T + \mathbf{x} \begin{bmatrix} 2 \\ 4 \end{bmatrix} = 3$$

Solution in terms of Matrix

- General equation of circle in matrix form:

$$\mathbf{x}\mathbf{x}^T - 2\mathbf{x}\mathbf{c}^T = r^2 - \mathbf{c}\mathbf{c}^T$$

- Here,
  on comparing with our equation
  $$-2\mathbf{c}^T = \begin{bmatrix} 2 \\ 4 \end{bmatrix}$$

- Centre of circle $\mathbf{c} = \begin{bmatrix} -1 & -2 \end{bmatrix}$

- $r^2 - \mathbf{c}\mathbf{c}^T = 3$

- $r^2 - 5 = 3$

- Radius of circle $r = 2^{3/2}$

- Given $P(1,0)$ is the point on the circle
- Let $Q(a,b)$ be the diametrically opposite point to P
- As $Q(a,b)$ lies on circle and diametrically opposite to $P(1,0)$
- So ,
- C is the mid point of $P(1,0)$ and $Q(a,b)$

- $C = \dfrac{P + Q}{2}$
- Q = 2C-P
- $Q = 2\begin{bmatrix} -1 & -2 \end{bmatrix} - \begin{bmatrix} 1 & 0 \end{bmatrix}$
- $Q = \begin{bmatrix} -3 & -4 \end{bmatrix}$
- Therefore ,
- $Q = \begin{bmatrix} -3 & -4 \end{bmatrix}$ is the diametrically opposite point to $P(1,0)$

Figure